

## **Technical Memorandum**

# **MIDWEST RESEARCH INSTITUTE**

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**To:** Bill Kuykendal

**From:** Greg Muleski

**Subject:** Revisions to AP-42 Section 13.2.1, "Paved Roads," EPA Contract 68-D-1-002, Work Assignment No. 1-03, MRI Project No. 110130.1.003

This memorandum summarizes the revisions made to AP-42 Section 13.2.1, "Paved Roads." The primary purpose for revising the section was to incorporate natural mitigation (because of precipitation) into long-term average emission factors for paved roads.

The current emission factor in Section 13.2.1 has been extrapolated to average uncontrolled conditions (but including natural mitigation) under two sets of assumptions (Options 1 and 2), as described below.

"Option 1" incorporates the essential features that are currently applied to paved road emissions estimates in the National Emission Inventory (NEI). The NEI extrapolation relies on an analogy with the long-term average unpaved road emission factors in Section 13.2.2. The new model (Equation 2 in the AP-42 Section) is of the form:

$$E_{\text{ext}} = k (sL/2)^{0.65} (W/3)^{1.5} (1 - P/2N) \quad (\text{Equation 2, Option 1})$$

$E_{\text{ext}}$  = annual or other long-term average emission factor in the same units as  $k$   
 $k$  = base emission factor (as given in AP-42 Table 13.2.1-1)  
 $sL$  = surface silt loading ( $\text{g/m}^2$ )  
 $W$  = average vehicle weight (tons)  
 $P$  = number of days with at least 0.254 mm (0.01 in) of precipitation during the averaging period  
 $N$  = number of days in the averaging period (e.g., 365 for annual, 91 for seasonal, 30 for monthly)

Note that extrapolation to a long-term average incorporates a factor of "2" in the denominator above. This is to account for the fact that paved roads dry more quickly than unpaved roads and therefore the mitigative effect of precipitation would not last, on average, for the full day.

"Option 2" extrapolates to a long-term average in much the same way, but uses hourly precipitation data instead.

$$E_{\text{ext}} = k (sL/2)^{0.65} (W/3)^{1.5} (1 - P/N) \quad (\text{Equation 2, Option 2})$$

where  $E_{\text{ext}}$ ,  $k$ ,  $sL$  and  $W$  are the same as before but

- $P$  = number of hours with at least 0.254 mm (0.01 in) of precipitation during averaging period  
 $N$  = number of hours in the averaging period (8760 for annual, 2124 for seasonal, 720 for monthly)

Note that under this option, extrapolation to a long-term average does not incorporate a factor of "2" in the denominator above. The assumption is that there are no emissions during any hour with measurable (0.254 mm) precipitation.

Figure 13.2.1-2 (which is identical to Figure 13.2.2-1 in the unpaved road section) has been added to provide the reader with a ready source of "wet" days per year data under Option 1. For Option 2, the reader is directed to National Climatic Data Center (NCDC) which offers several products that provide hourly precipitation data. In particular, NCDC offers *Solar and Meteorological Surface Observation Network 1961-1990* (SAMSON) CD-ROM, which contains 30 years worth of hourly meteorological data for first-order National Weather Service locations.

Text has also been added to emphasize that neither assumption underlying the long-term average emission factor has been verified in any rigorous manner. For that reason, the reader is instructed to downgrade the quality rating of the extrapolated emission factor by one letter. Additional minor text revisions were made to enhance readability.

Other minor revisions include updating Section 13.2.1.5, "Changes since Fifth Edition" and revising the references.